Results from the search for a stochastic gravitational wave background in the NANOGrav 12.5-year dataset

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Gravitational Wave Spectrum

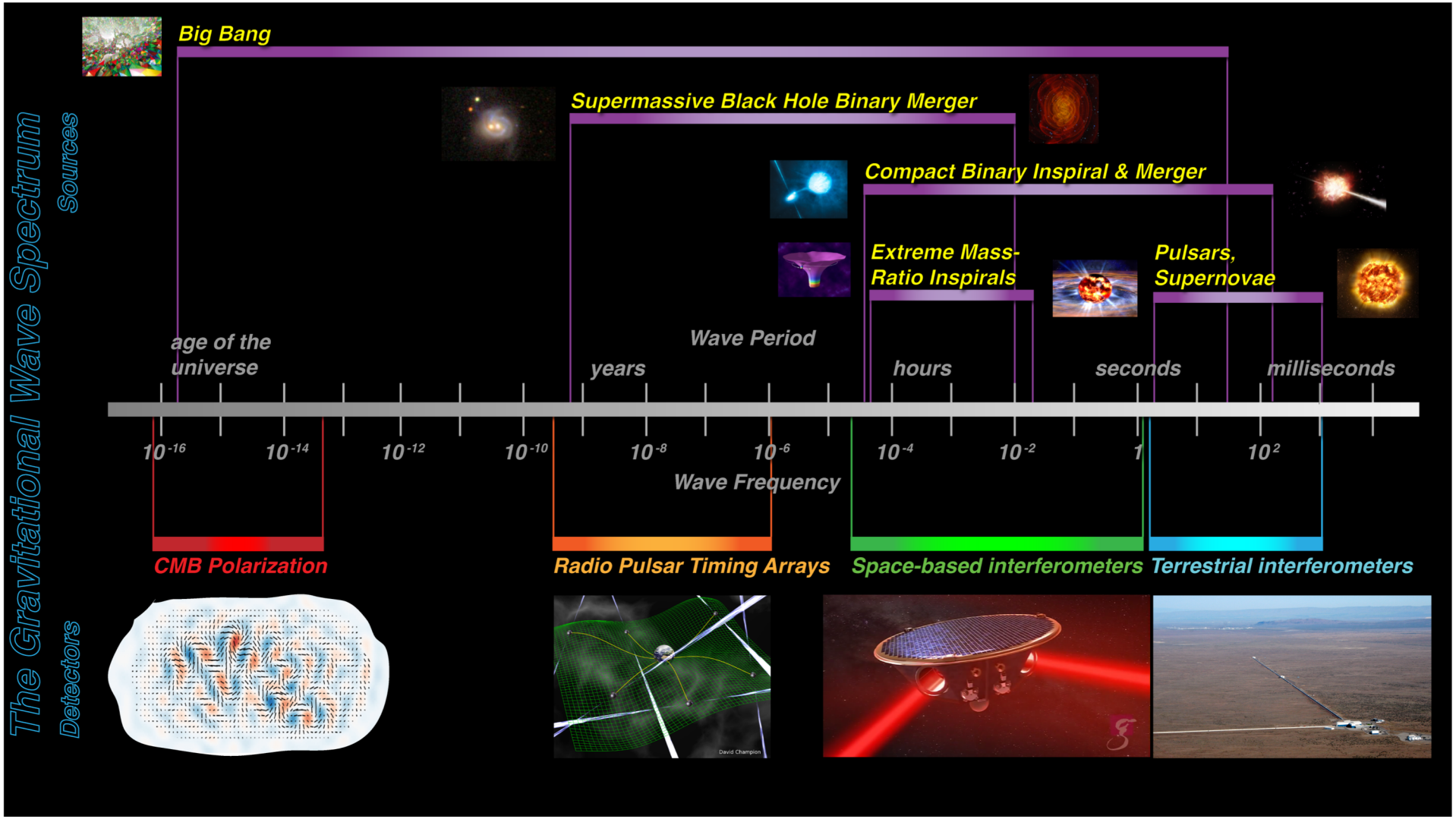
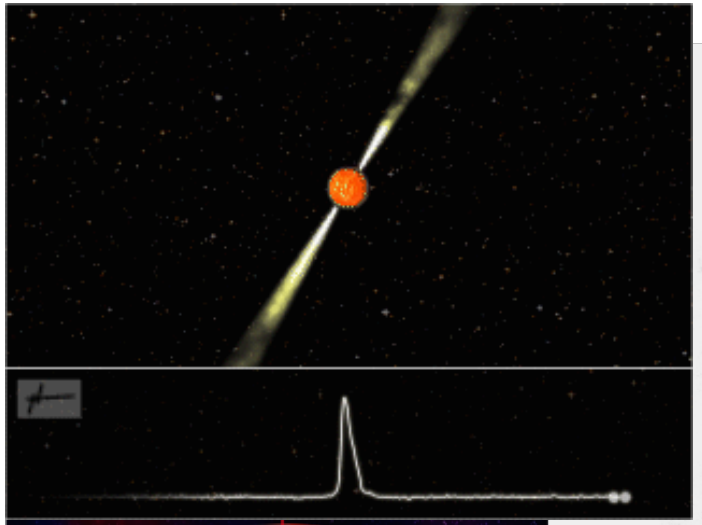
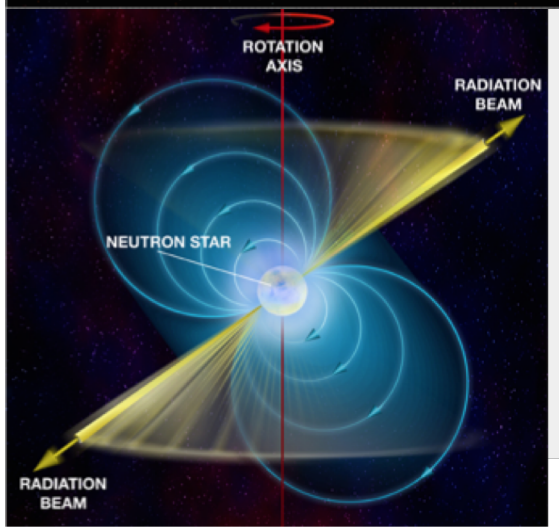
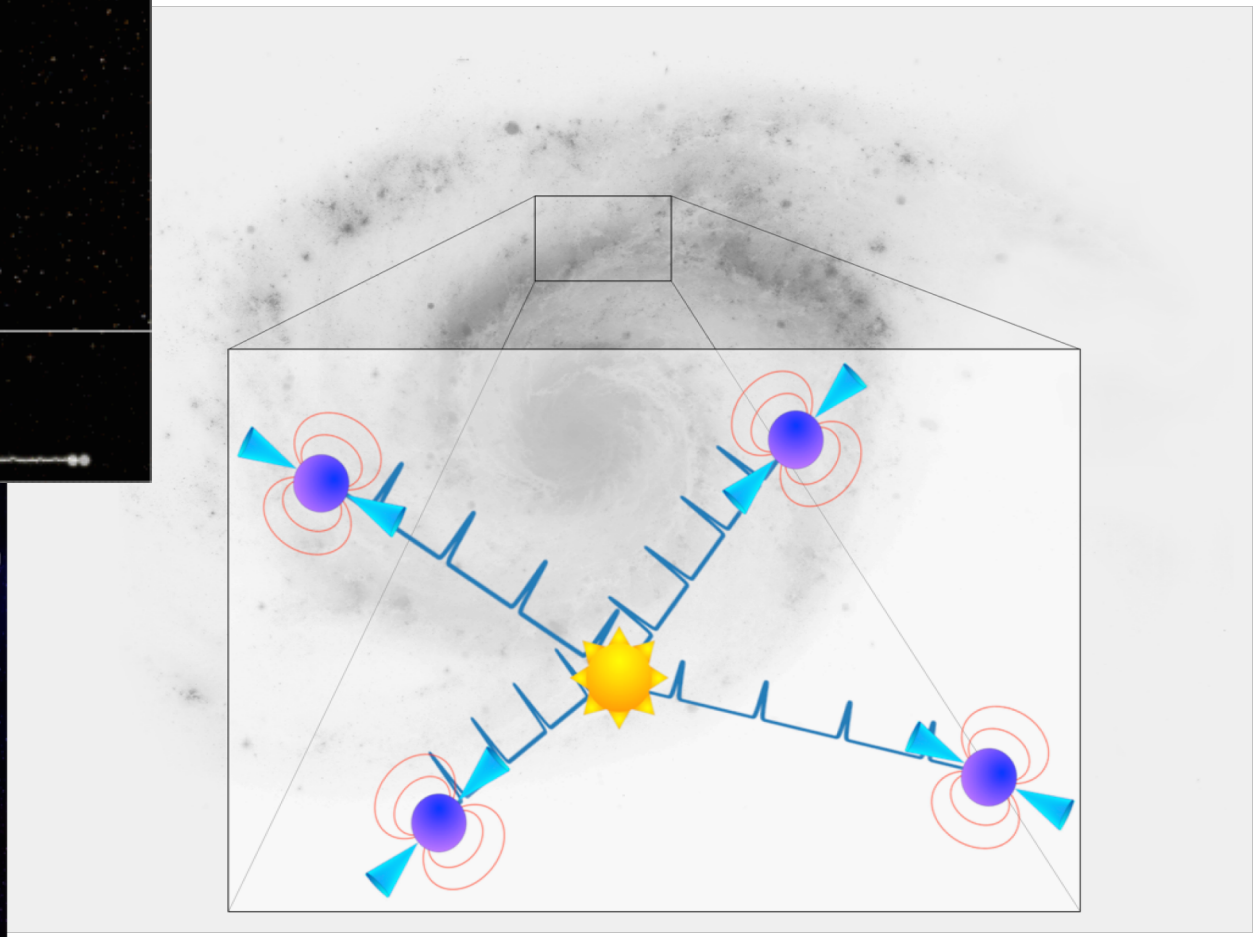


Image Credit: I. Thorpe, NASA/GSFC

Pulsar Timing Arrays







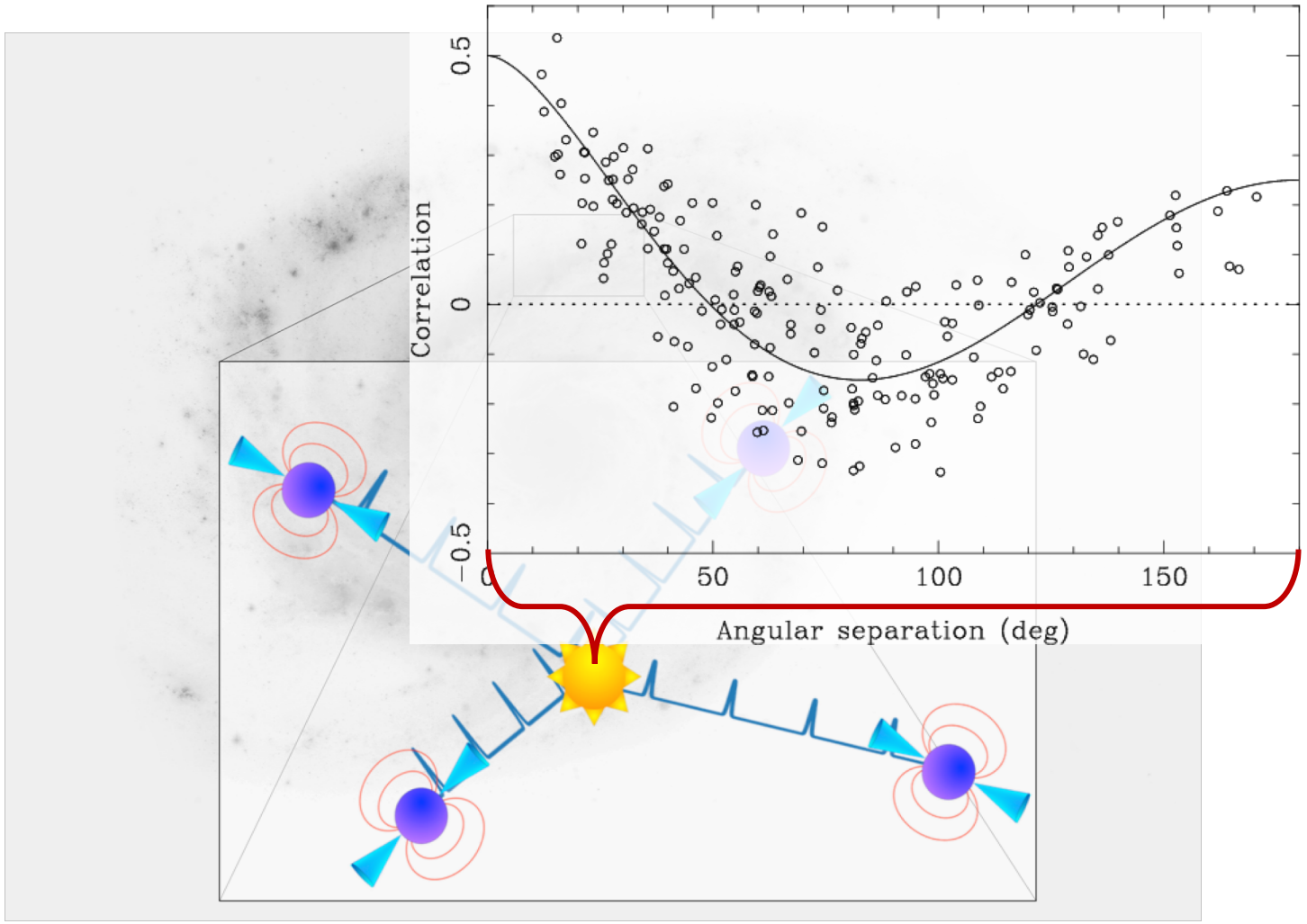
Credit: J. van Leeuwen, Bill Saxton, NRAO/AUI/NSF, J. Hazboun

Observe a large set of millisecond pulsars, which are stable clocks, rivaling atomic clocks, with precision of ~100 ns

Each pulsar-to-earth system is comparable to an interferometer arm

Search for correlated perturbations in pulse time-of-arrivals indicative of passing gravitational wave

Pulsar Timing Arrays



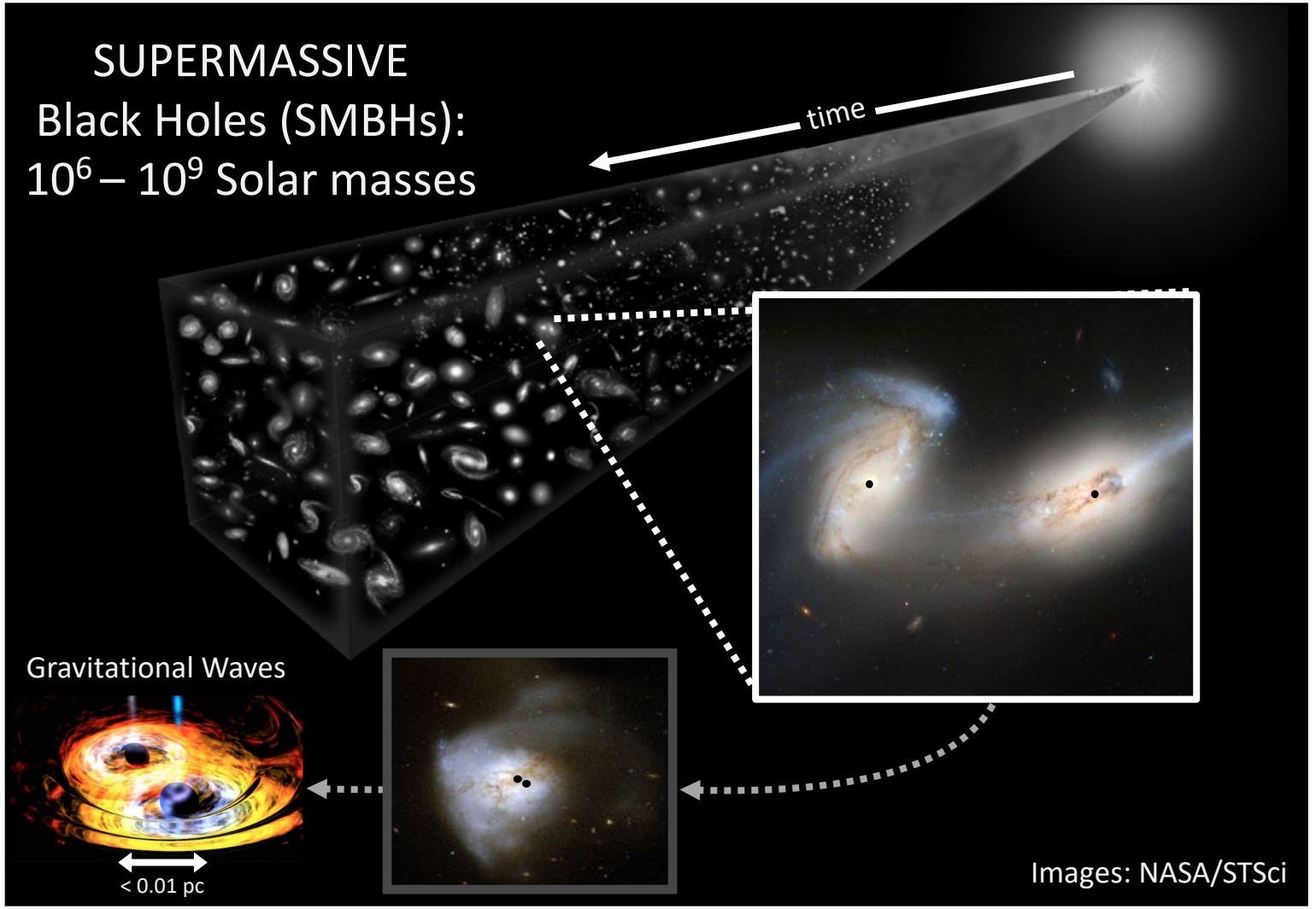
Credit: J. Hazboun, Hellings & Downs (1983)

Search for correlated perturbations in pulse time-of-arrivals indicative of passing gravitational wave

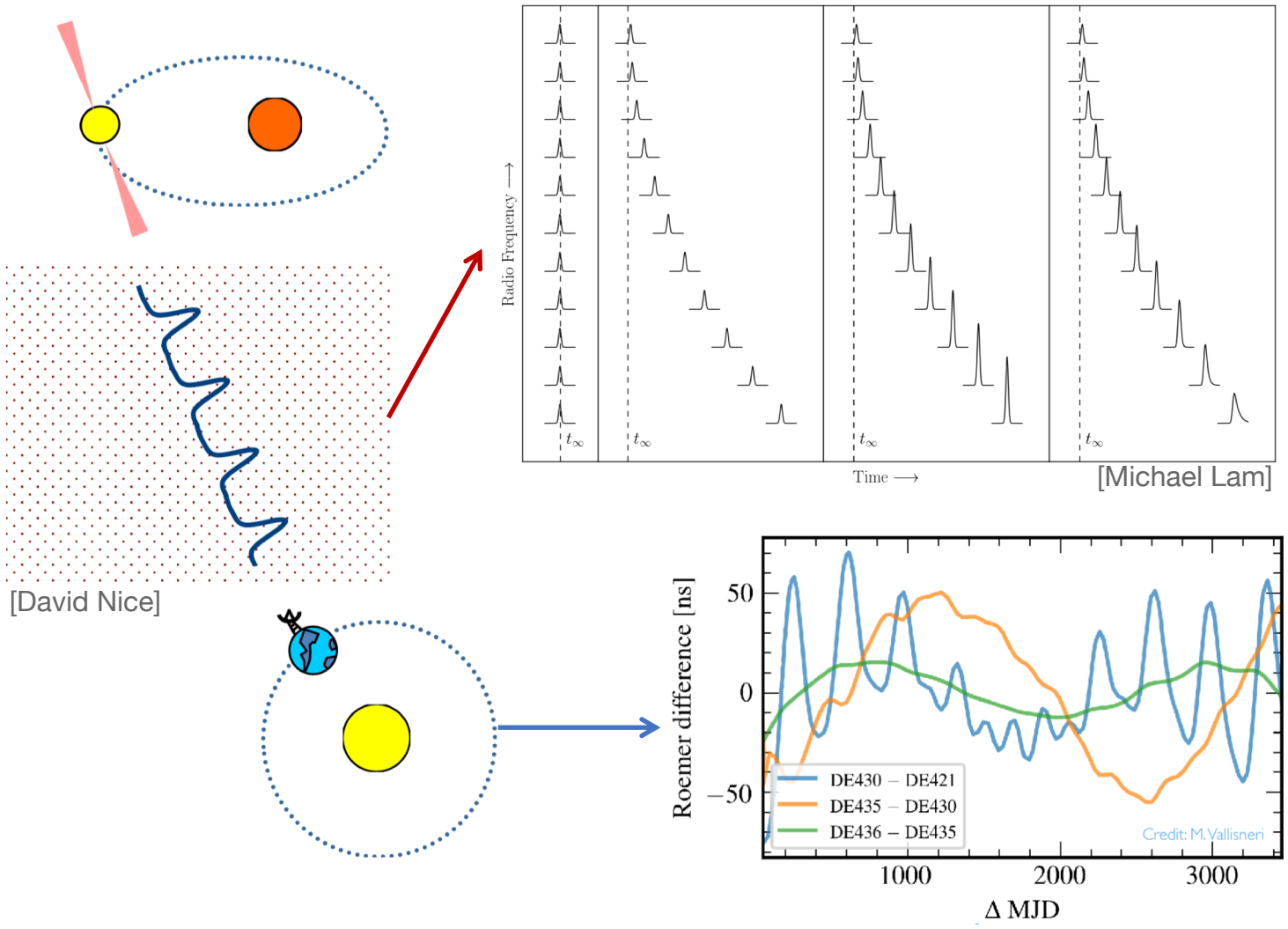
Many pulsar pairs are required for successful identification of gravitational wave

GW signal is imbedded in entire data stream.

PTA Gravitational Wave Sources



Noise Modeling for PTAs

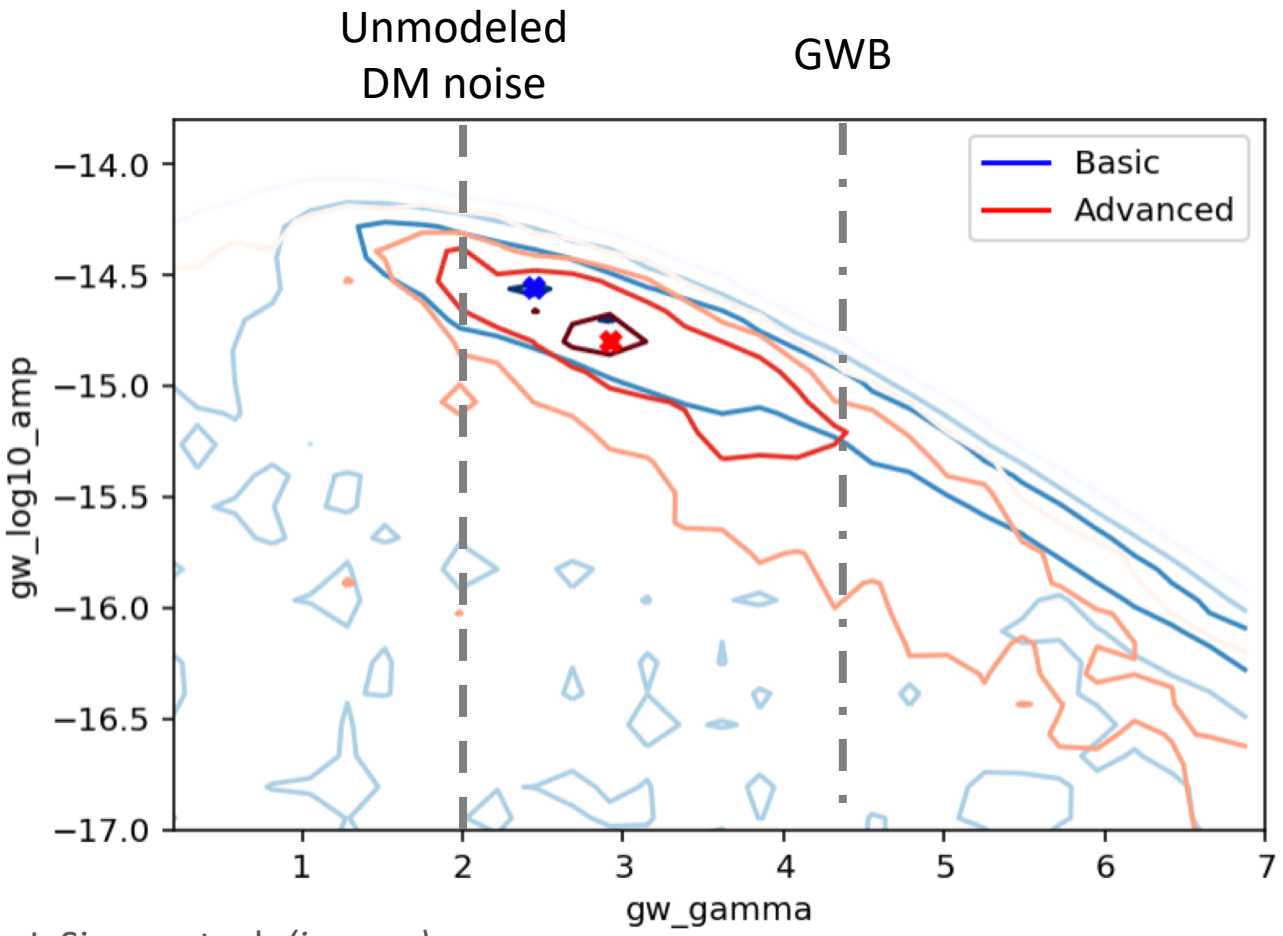


Pulses propagate through the interstellar medium getting dispersed and scattered.

Accurate pulse arrival times are reliant upon accurately correcting for the orbit of the Earth in the solar system.

We have developed new models to better account for these effects in our dataset.

Advanced Noise Models: NANOGrav 11yr Dataset



J. Simon et. al. *(in prep)*

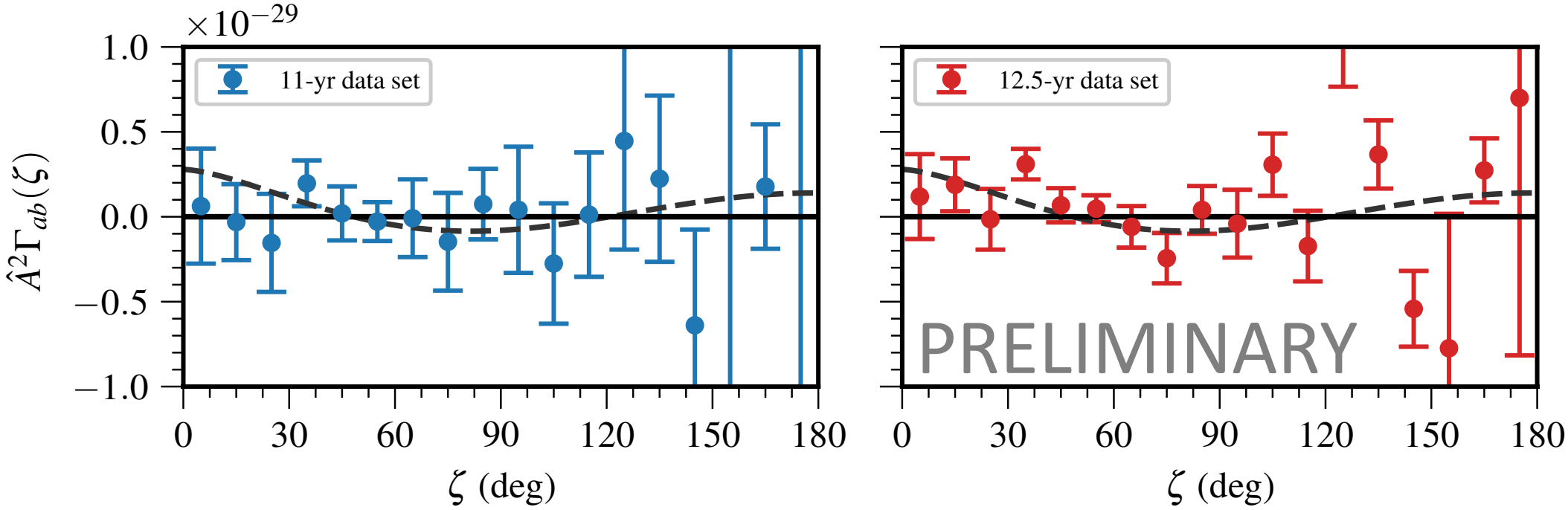
By using a Guassian Process to model the Dispersion Measure (DM), we can account for the different kinds of dispersive effects and better isolate the DM noise from the gravitational wave background (GWB).

Methods were developed on and applied to the NANOGrav 11-year dataset to test their effectiveness.

Preliminary Results: NANOGrav 12.5yr Dataset

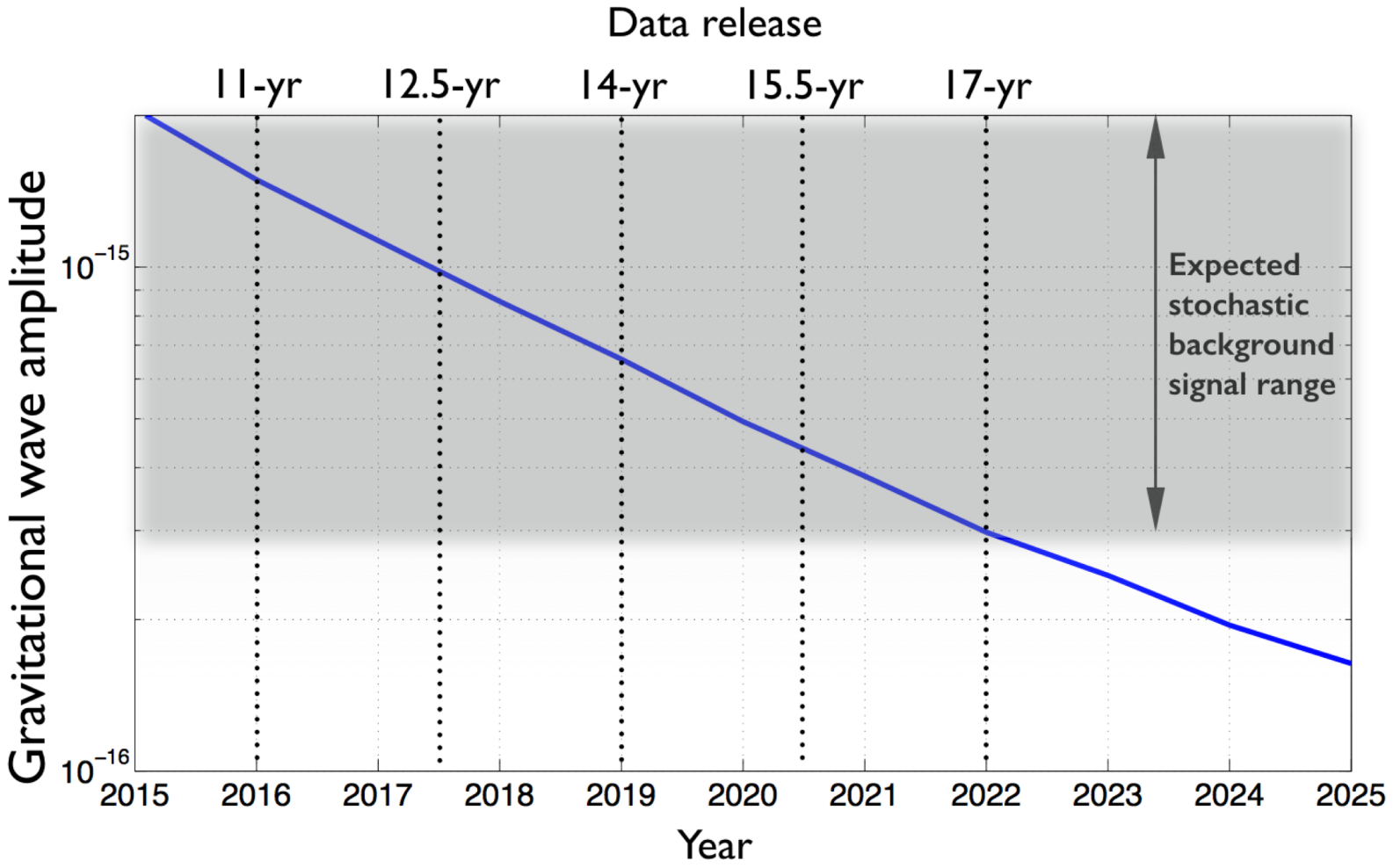
Preliminary search shows increased sensitivity to gravitational wave background (GWB)

Currently applying advanced noise models, which will increase our ability to isolate the GWB from other noise sources



Arzoumanian et. al. *(in prep.)*

Future Prospects



Open Questions in the GW Background